

WE CLAIM:

1. A micro-miniature x-ray apparatus for steering focused x-rays in a selected direction, said apparatus comprising:

5 a first chip subassembly including a radiation source for generating both Bremsstrahlung photons and characteristic x-rays,

a second chip subassembly including a filter for preferentially transmitting the characteristic x-rays but blocking the Bremsstrahlung photons,

10 a third chip subassembly including a movable element for focusing or collimating the transmitted characteristic x-rays into a beam and means for controlling the position of the movable element.

2. The apparatus of claim 1, wherein said movable element comprises a Fresnel device for focusing said characteristic x-rays.

15 3. The apparatus of claim 1, wherein said movable element comprises a multiplicity of capillaries for collimating said characteristic x-rays.

20 4. The apparatus of claim 1, wherein said x-ray source comprises an array of field emitters for generating electrons, a target responsive to said electrons for generating said x-rays, and an acceleration electrode for accelerating said electrons as they move from said emitters to said target.

25 5. The apparatus of claim 4, wherein said acceleration electrode is segmented into a multiplicity of separate electrodes, and further including means for applying voltage to selected ones of the segmented electrodes.

30 6. The apparatus of claim 4, further including an electron lens for focusing said electrons onto said target.

7. The apparatus of claim 1, wherein said filter includes a spatial filter for blocking said Bremsstrahlung photons.

8. The apparatus of claim 7, wherein said spatial filter includes an aperture for blocking those Bremsstrahlung photons whose propagation direction is outside a preselected angular cone.

5 9. The apparatus of claim 7, wherein said characteristic x-rays include x-rays at different frequency bands and wherein said filter includes a spectral filter for blocking x-rays at at least one of said frequency bands.

10 10. The apparatus of claim 1, wherein said controller comprises a MEMS controller including a support structure including a base and having an opening in which said movable element is suspended, resilient means for coupling said element to said structure, and a multiplicity of first control electrodes located on said base, said element serving as a second control electrode, so that voltage applied between said second electrode and selected ones of said first electrodes controls the movement of said element.

15 11. The apparatus of claim 10, wherein said filter includes a spatial filter for blocking said Bremsstrahlung photons, said spatial filter comprising an annular member that surrounds an aperture for blocking those Bremsstrahlung photons whose propagation direction is outside a preselected angular cone, and said annular member forming said base on which
20 said first control electrodes are located.

12. The apparatus of claim 1 further including a catheter, said apparatus being mounted on the end of said catheter.

25 13. A micro-miniature x-ray apparatus for steering focused x-rays in a selected direction, said apparatus comprising:

a radiation source for generating both Bremsstrahlung photons and characteristic x-rays,

a filter for preferentially transmitting the characteristic x-rays but blocking the
30 Bremsstrahlung photons,

a movable element for focusing or collimating the transmitted characteristic x-rays into a beam and means for controlling the position of the movable element.